HOUSING CUP FOR AN ELECTRONIC COMPONENT WITH INTEGRATED COOLING BODY

BACKGROUND

Field

The invention relates to a housing for an electronic component, substantially comprising a housing cup.

Discussion of Related Art

In the operation of electronic components, depending on their specific field of use, sometimes considerable power loss occurs in the form of heat. Higher losses cause increased heat stress. The heat stress has a decisive influence on the shortening of the service life of the electronic component. This heat must be dissipated via the housing of the electronic component. The capacity of the housing for heat dissipation thus substantially determines the service life, the specific field of use, and the electrical design of the electronic component. Improved heat dissipation as a rule means increased current-carrying capacity or the allowance of higher ambient temperatures. To reduce heating and electronic components, they are sometimes oversized, or tasks in electronic circuits are distributed by means of assemblies connected to one another to a plurality of what as a rule are identical electronic components. This is known particularly from the parallel connection of capacitors. As a result, loads for individual components are reduced while at the same time the cooling surface areas are increased. Alternatively, a cooling body is often secured, particularly by screwing, to the housing of the electronic component. The heat transfer between the electronic component

and the cooling body can be improved still further by means of a heat-conducting foil known as "Thermopads" as an intermediate layer, or by means of corresponding heat-conducting pastes.

From German Patent DE 198 17 493 C1, an electrolyte capacitor is known, whose housing is provided with a number of cooling fins. The housing of the known capacitor is embodied as a cast aluminum part.

Housings for electronic components are often formed in cylindrical form. For these housings, depending on their internal construction and the type of electronic component, heat dissipation via the cylinder base can have decisive importance. This is particularly true for electronic components in which the heat-conducting capacity in the radial direction is less, particularly because of their internal construction. In this case, the air gap, which in some cases is up to several millimeters wide, between the electronic component and the housing acts as an internal heat resistor.

However, heat dissipation via the cup base can be comparatively impaired, because optimal electrical contact, for the sake of heat dissipation, of the cup base with the electronic component is not achieved without additional provisions. It is known that for this reason, in a capacitor, for instance, the cathode foil must be made to protrude from the lower end of the coil, so that greatly improved heat connection of the coil to the cup base is accomplished on one side.

Oversizing electronic components is disadvantageous because of the increased material required; the parallel

connection of an increased number of electronic components is also disadvantageous because of the higher production costs and the increased effort of assembly. Retroactively securing a cooling body to the housings of electronic components also involves comparatively great effort of assembly.

SUMMARY

The object of the invention is to improve the heat emission capacity of an electronic component.

This object is attained according to the invention by a housing cup for an electronic component which is produced by extrusion and is characterized in that the cup base is formed into a cooling body that is integral with the housing cup.

By integrating the cooling body with the housing cup, the current-carrying capacity of the electronic component, compared to a corresponding electronic component with a smooth housing wall, can be increased substantially, by more than 100%, depending on the type of electronic component. No substantial additional costs occur in producing the housing cup, especially since the cooling body is stamped out jointly in the same work step with the stamping of the housing cup. The cooling action of the housing cup is also enhanced by producing it by extrusion. Because of the compaction of the housing material and because of the material structure developed in the course of the flow of material, the heat-conducting capacity of the housing cup is favorably influenced.

In a preferred version, the cooling body includes a number of protrusions, which protrude from the cup base essentially in the axial direction of the housing cup. In expedient variants, these protrusions are embodied

selectively in pin-like, prism-like or lamination-like form. Various forms of protrusions can furthermore be used in combination.

The basic shape of the housing cup is essentially cylindrical. The cylindrical shape of the housing cup has proved advantageous, particularly because of its excellent pressure stability.

In a further advantageous variant, especially when a plurality of electronic components are connected to one another, the cooling body or at least one of its axial protrusions is used as a mechanical guide element. This element can advantageously be employed in arrangements in which larger electronic components have to be connected to one another to form multicomponent assemblies, where because of the particular way the product is used, increased resistance to shock and jarring is necessary.

An advantageous version is obtained if the cooling body is cooled directly or indirectly by means of a fluid. With direct cooling, the cooling body is bathed directly by the fluid, such as deionized water. In the indirect variant, the element used for mechanically guiding the electronic component has fluid flowing through it, or the cooling body itself is embodied such that it can be connected to cooling elements (cooling hoses, cooling tubules). In this way, maximum heat removal from the housing surface can be achieved.

The object is attained in particular by a capacitor - especially an electrolyte capacitor having an embodiment of the housing cup as described above. In the capacitor, higher losses occur particularly with the use of alternating voltage

or voltages of increasing waviness, because of the resultant alternating current or the resultant current of increased waviness, and because of the comparatively higher substitute series resistance. The consumption of the service life of the capacitor and the attendant worsening of its electrical parameters (capacitance) especially are higher and are directly dependent on the heat development in the capacitor. Because of the internal construction of the component, the heat removal via the cup base plays a decisive role in the capacitor, since in the radial direction the heat-conducting capacity is limited because of its particular construction. The air gap, up to several millimeters wide, between the coil and the side wall acts as an additional heat resistor.

Still further improved cooling of the capacitor is achieved whenever the capacitor winding, comprising two capacitor foils and a dielectric, is wound in such a way that a capacitor foil protrudes from the capacitor winding base, and thus the cup base formed into the cooling body is connected electrically directly to the protruding capacitor foil.

Compared to electrically contacting the capacitor foil with a smooth cup base without an additionally formed cooling body, or a cup base formed into the cooling body without direct electrical contacting of the capacitor foil to the cup base, the heat emission capacity and thus the alternating current load and/or service life of the capacitor can be increased further by multiple times. By disposing the cooling body on the cup base, especially effective heat dissipation is attained, since on the cup base, the thermal contact between the housing cup and the capacitor winding of the capacitor is especially good.

The object is further attained according to the invention by a production method for producing the aforementioned housing cup.

In this method, the housing cup of the electronic component is produced by extrusion. In the course of the pressing operation, an integrated cooling body is formed into the cup base. The production method of the invention is based on an extrusion method using a matrix, which in a base region is provided with the negative shape of the cooling body to be made.

The advantages attained with the invention are particularly that the current-carrying capacity of the electronic component is increased substantially because of the improvement in heat dissipation to the housing surface and by improving the heat removal from the housing surface, without entailing significant additional expenses for producing the component. The higher current-carrying capacity of the electronic component makes a cost reduction possible in making electronic circuits, especially since the number of electronic components to be connected to one another can be reduced. For the same service life, the electronic component equipped according to the invention is capable of carrying higher current than a conventional one with a smooth cup wall. Conversely, if the load on the electronic component remains the same, a longer service life is attained. The housing cup of the invention is also especially easy to manipulate, especially since the additional effort for attaching cooling bodies can be eliminated.

The increased heat removal from the housing surface is assured by the integration of a cooling body into the cup base. Preferably in multicomponent assemblies, the heat

transport is positively influenced by directly contacting the cooling body with separate air- or fluid-cooled elements. Still another substantial increase in heat dissipation is attained by the direct electrical contacting of the capacitor winding with the cup base.

BRIEF DESCRIPTION OF THE DRAWINGS

Exemplary embodiments of the invention will be described further detail below in conjunction with drawings. Shown in them are:

Fig. 1, in a schematic cross section, a housing for an electronic component with a housing cup and a cooling body integrated into the cup base;

Fig. 2, a top view on the cup base and the cooling body that is provided with pin-like protrusions;

Fig. 3, in a view corresponding to Fig. 2, an alternative embodiment of the cooling body, in which the protrusions are embodied in lamination-like form;

Fig. 4, a cylindrical capacitor winding, stamped out such that the capacitor foil protrudes from the capacitor winding base;

Fig. 5, in a schematic cross section, a capacitor comprising a housing as shown in Fig. 1 and a capacitor winding as shown in Fig. 4;

Fig. 6, a multicomponent assembly for capacitors with indirect cooling.

DETAILED DESCRIPTION

Elements corresponding to one another are identified by the same reference numerals in all the drawings.

The housing, schematically shown in Fig. 1, for an electronic component 1 includes a cylindrical housing cup 2, which is closed off with a housing cap 3. In the interior of the housing formed by the housing cup 2 and the housing cap 3 is the electronic component 4, which is electrically contacted by two wirelike terminal contacts 5 that are passed through the housing cap 3.

The housing cup 2 has a tubular side wall 6, which is closed off, on the face end opposite the housing cap 3, by a cup base 7 embodied integrally with the side wall 6. The cup base 7 forms the bottom face of a cooling body 8 embodied integrally with the housing cup 2. The cooling body 8 further includes a number of protrusions 9, which protrude from the outer surface of the cup base 7 in the axial direction 10 of the housing cup 2 and spaced apart from one another.

Figs. 2 and 3, in a view counter to the axial direction 10 on the cup base 7, show two alternative embodiments of the protrusions 9. In Fig. 2, the protrusions 9 are embodied in pin-like form. In Fig. 3, the protrusions 9 have the shape of laminations. In both versions, the cross section through the electronic component housing 1 corresponds to the view in Fig. 1.

Besides the versions shown in Figs. 2 and 3, the protrusions 9 may also (in a manner not shown) be embodied as prism-like.

The housing cup 2, including the cooling body 8, is produced in a single work step by means of extrusion. This

technique is already used for producing a conventional, smooth housing cup for a conventional electrolyte capacitor. For embodying the cooling body 8, the conventional production method is modified such that the matrix of a pressing device, used for producing the housing cup 2, is provided in a base region with the negative shape of the cooling body 8 to be made. In the pressing operation of the housing cup 2, the cooling body 8 is then automatically molded with it.

Fig. 4 shows a cylindrical capacitor winding 15. The capacitor winding 15 is created by winding up a material composed of at least three layers. One layer forms the cathode foil 12; another layer forms a dielectric made of electrolyte-saturated paper 13; and a third layer forms the anode foil 14. The various layers are located one above the other but not with projection precision. The capacitor winding 15 is stamped out such that the cathode foil 12, on a capacitor winding base, has an offset from the paper layer and anode foil. Thus on both sides, the electrolyte-saturated intermediate paper layer 14 insulates the cathode foil 12 and the anode foil 13 from one another.

The capacitor 16 schematically shown in Fig. 5 includes a cylindrical housing cup 2, which is closed off with a housing cap 3. Located in the interior of the housing formed by the housing cup 2 and the housing cap 3 is the capacitor winding 11, which is electrically contacted by two wirelike terminal contacts 5 passed through the housing cap 3. The interior of the housing 2 and housing cap 3 is also filled with an electrolytic fluid F. The capacitor winding base 15, with its protruding capacitor foil, directly contacts the inside of the cup base 7 electrically.

Fig. 6 schematically shows an arrangement of capacitors

16 according to the invention, whose cooling bodies 8 are connected in heat-conducting fashion to a mechanical fastening element 17. The mechanical fastening element 17 comprises heat-conducting material and has conduits through which a fluid flows as a cooling fluid.

In an exemplary embodiment not shown, the cooling body 8 of a capacitor 16 may also be embodied such that it is connected directly to a cooling hose or cooling tube. The cooling body may for instance have a bore, through which a cooling hose or cooling tube is passed, or it may be embodied such that a cooling hose or cooling tube can be fastened to it.